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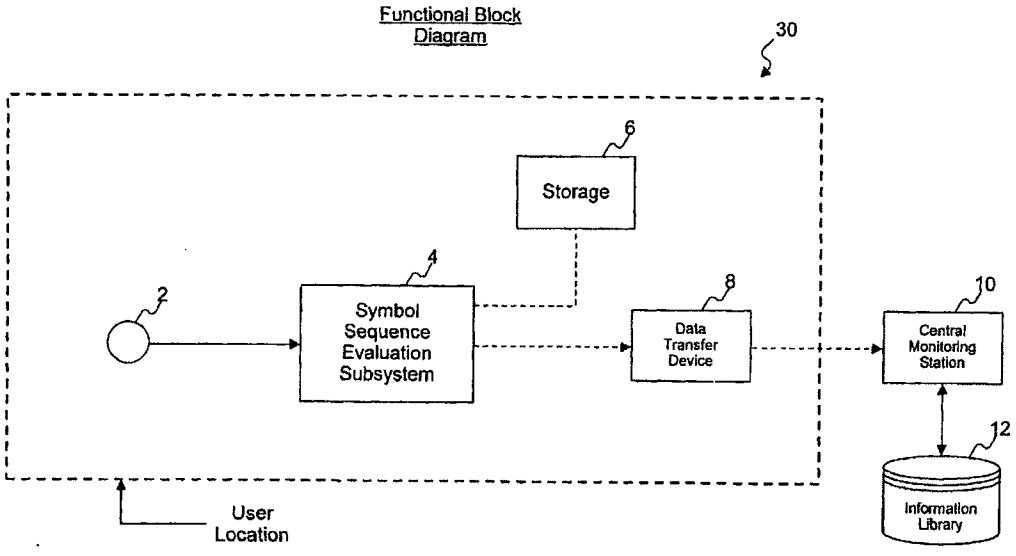
(54) Title: MESSAGE RECONSTRUCTION FROM PARTIAL DETECTION



(57) Abstract: A method and system (30) for reliably detecting encoded messages included in audio media data (2) in varying acoustic environments, where only a portion of the predetermined message may have been received or detected (4).

WO 03/024016 A1

Title Of Invention

MESSAGE RECONSTRUCTION FROM PARTIAL DETECTION

Background Of The Invention

[0001] The present invention relates to methods and systems for accurately detecting encoded data included in audio media data.

[0002] There is considerable interest in encoding audio signals for use in audience measurement. In order to estimate what an audience is listening to at a particular time, a listener's environment is monitored for audio signals at regular intervals. If the detected audio signals contain an identification code, the message may then be quickly identified.

[0003] Based upon the receipt of identified messages, the rating or popularity of various broadcasts may be estimated. Therefore, it is very important to accurately determine which encoded audio signals have been received.

[0004] However, the acoustic characteristics of differing audio environments may vary greatly. As a result, rates for successfully receiving and identifying audio signals in the differing environments can vary significantly. Some environments for instance, may be quite hostile to the accurate detection of encoded messages because there is a large amount of noise or interference. There may also be circumstances in which the encoded message may not be detected because of a dropout in the code. In these cases, only a portion of the identification code may be received.

[0005] Therefore, a system is desired with reduced sensitivity to the acoustic environment, which can detect a code in as many differing circumstances as possible despite hostile acoustic conditions.

[0006] A system is also desired that can accurately identify the detection of an encoded message, even if only a portion of the message has been received or detected.

Summary Of The Invention

[0007] For this application the following terms and definitions shall apply:

[0008] The term "data" as used herein means any indicia, signals, marks, symbols, domains, symbol sets, representations, and any other physical form or forms representing information, whether permanent or temporary, whether visible, audible, acoustic, electric, magnetic, electromagnetic or otherwise manifested;

[0009] The term "audio media data" as used herein means any data representing or constituting audible sounds and which is widely accessible whether over-the-air, or via cable, satellite, network, internetwork (including the internet), distributed on storage media, or otherwise;

[0010] The term "message symbol" as used herein means a unit of data selected from a predefined symbol set to constitute part of a message contained in data included in audio media data;

[0011] The term "continuing stream of encoded messages" means encoded messages arranged in a predetermined time or spatial sequence, whether the sequence is continuous or interrupted;

[0012] The term "processor" as used herein means processing devices, apparatus, programs, circuits, systems and subsystems, whether implemented in hardware, software or both, and includes both individual units and groups of units;

[0013] The term "produce" as used herein with respect to data means to retain existing data for further processing as well as to derive new data based on pre-existing data, and:

[0014] The terms "first", "second" and "further" are used to distinguish one element, set, data, object or thing from another, and are not used to designate relative position or arrangement in time.

[0015] In accordance with one aspect of the invention, a method is provided for detecting data included in audio media data as a continuing stream of encoded messages. The method comprises detecting predetermined message data representing a predetermined message of the continuing stream of encoded messages; producing message detection merit data representing an assigned accuracy of the detected predetermined message data as correctly representing an information content of the predetermined message; and confirming correct detection of the predetermined message based on the message detection merit data.

[0016] In accordance with another aspect of the present invention, a system is provided for detecting data included in audio media data as a continuing stream of encoded messages. The system comprises detecting means for detecting predetermined message data representing a predetermined message of the continuing stream of encoded messages; merit data producing means for producing message detection merit data representing an assigned accuracy of the detected predetermined message data as correctly representing an information content of the predetermined

message; and confirming means for confirming correct detection of the predetermined message based on the message detection merit data.

[0017] The invention and its particular features and advantages will become more apparent from the following detailed description considered with reference to the accompanying drawings.

Brief Description Of The Drawings

[0018] FIGURE 1 is a functional block diagram illustrating a system in accordance with one embodiment of the present invention.

[0019] FIGURE 2 is a block diagram illustrating an embodiment of the system of Figure 1.

[0020] FIGURE 3 is a flow diagram illustrating one mode of operation of the systems of Figures 1 and 2.

[0021] FIGURE 4 is a flow diagram illustrating an implementation of one process of Figure 3.

[0022] FIGURES 5 through 8 are graphs illustrating continuing streams of encoded messages.

[0023] FIGURE 9 is a graph illustrating an advantageous format of a message included in a continuing stream of encoded messages.

Detailed Description Of Certain Advantageous Embodiments

[0024] Figure 1 is a functional block diagram illustrating an advantageous embodiment of a system 30 for detecting data included in audio media data as a continuing stream of encoded messages. In certain embodiments, the continuing stream of encoded messages includes data

useful in audience measurement, commercial verification, royalty calculations and the like. Such data typically includes an identification of a program, commercial, file, song, network, station or channel, or otherwise describes some aspect of the media audio data or other data related thereto, so that it characterizes the audio media data. In certain embodiments, the continuing stream of encoded messages is comprised of symbols arranged time-sequentially in the audio media data.

[0025] The system 30 comprises an audio media data input 2 for detecting data included in audio media data as a continuing stream of encoded messages. The audio media data input 2 can be either a single device, stationary at a source to be monitored, or multiple devices, stationary at multiple sources to be monitored. Alternatively, the audio media data input 2 can be a portable monitoring device that can be carried by an individual to monitor multiple sources as the individual moves about.

[0026] Where the audio media data is acoustic data, the audio media data input 2 typically would be a microphone having an input which receives audio media data in the form of acoustic energy and which serves to transduce the acoustic energy to electrical data. Where audio media data in the form of light energy, is monitored, the audio media data input 2 takes the form of a light-sensitive device, such as a photodiode. The audio media data input 2 can also take the form of a magnetic pickup for sensing magnetic fields associated with a speaker, a capacitive pickup for sensing electric fields or an antenna for electromagnetic energy. In still other embodiments, the audio media data input 2 takes the form of an electrical connection to a monitored device, which may be a television, a radio, a cable converter, a satellite television system, a game playing system, a VCR, a DVD player, a portable player, a computer, a web appliance, or the like. In still further embodiments, the audio media data input 2 is embodied in monitoring software running on a computer or other reproduction system to gather media data.

[0027] A symbol sequence evaluation subsystem 4 receives input data from audio media data input 2. The symbol sequence evaluation subsystem 4 processes the input data to detect the presence of symbols which may represent encoded messages included in audio media data as a continuing stream of encoded messages. For example, the symbols may be detected in accordance with any of the techniques disclosed in U.S. Patent No. 5,764,763 to Jensen et al., U.S. Patent No. 5,450,490 to Jensen et al., U.S. Patent No. 5,579,124 to Aijala et al., U.S. Patent No. 5,581,800 to Fardeau et al., U.S. Patent No. 5,319,735 to Preuss et al., U.S. Patent No. 6,175,627 to Petrovich et al., U.S. Patent No. 5,828,325 to Wolosewicz et al., U.S. Patent No. 6,154,484 to Lee et al., U.S. Patent No. 5,945,932 to Smith et al., PCT applications WO 00/04662 to Srinivasan, WO 98/26529 to Lu et al., WO 96/27264 to Lu et al., WO 99/59275 to Lu et al., and U.S. patent application No. 09/318,045 to Neuhauser, et al., all of which hereby are incorporated by reference herein.

[0028] A storage device 6 is optionally provided to store data. It may be desired to store the data produced by the symbol sequence evaluation subsystem 4 for later use. In addition, an optional data transfer device 8 is provided, if desired, to transmit data from the symbol sequence evaluation subsystem 4 to a remote location, such as a central monitoring station 10, which has an accompanying information library 12. The data produced by the symbol sequence evaluation subsystem 4 may be transferred to the central monitoring station 10 as a continuous or a continuing stream of data. Alternatively, the data produced by the symbol sequence evaluation subsystem 4 may be stored in storage device 6 for time shifted communications with the central monitoring station 10. The information library 12 accessible by the central monitoring station 10 may be utilized for instance, to produce identification data for the audio media data based on the information content of the received messages.

[0029] Figure 2 is a block diagram illustrating an advantageous implementation 100 of the system 30. The system 100 comprises an audio media data input 2 for data, which may include audio media data having a continuing stream of encoded messages therein. The audio media data input 2 may take any of the forms described in connection with Figure 1 above.

[0030] System 100 includes a message processor 14 which serves to process the received data in the same manner as subsystem 4 of Figure 1 described more fully in connection with Figure 3 below, to detect continuing streams of messages included in the received data.

[0031] Storage device 16 has been provided to store detected symbols which comprise the messages, as well as message information data representing the information content of the messages, and message detection merit data representing an assigned accuracy of the message information data or a likelihood that it is correct, all produced by the message processor 14. The message information data and the message detection merit data may later be used to confirm the detection of a predetermined message. Communications device 18 has been provided in order to communicate data from the message processor 14 to the central monitoring station 10 with its accompanying information library 12. The data communicated by communications device 18 includes confirmed or unconfirmed message information data with or without message detection merit data communicated at the time of detection from message processor 14 as a continuous or continuing stream of data. Alternatively, the data communicated by communications device 18 includes confirmed or unconfirmed message information data with or without message detection merit data communicated from storage device 16.

[0032] Figure 3 illustrates one mode of operation of the systems 30 and 100 to detect a message A of a continuing stream of encoded messages included in audio media data wherein each message comprises a plurality of

message symbols. From the stream of messages, a symbol sequence is examined at 34 to detect the presence of a message in a predetermined format, labeled "message A" for convenience herein. The symbol sequence may be selected for examination in any of a number of different ways. In one embodiment, each group of S sequential symbols or data which potentially could correspond thereto based on the length or duration of the data, is examined in the step 34. In an alternative embodiment, a group of S sequential symbols or data which could correspond thereto is selected based on a prior detection of one or more other messages in the sequence. In a further embodiment the detection of a symbol characterizing a known position in a message symbol sequence, such as a synchronization symbol, is used to select the data to be examined in step 34.

[0033] Since the message A has a predetermined format, in carrying out the step 34 the systems 30 and 100 are able to rely not only on detection of the individual symbols but also on the message format in determining whether a message has been fully detected. If, for example, message A is composed of S sequential symbols X_1, X_2, ...X_s, of which X_i is a synchronization symbol, the step 34 may be carried out on the condition that the synchronization symbol S_i has been detected. Then the positions of the remaining symbols are known and their presence or absence determined.

[0034] If all of the symbols of the message A have been detected, the sequence of symbols in message A are assigned a highest message detection merit data value M_{MAX}, representing a maximum likelihood that message A has been detected, and are stored and/or transferred 46 as message information data representing an information content of the message A, with or without the data M_{MAX}, for further processing.

[0035] If not all of the symbols of message A are detected, but those that were detected constitute a qualified subset of the message A, determined at 40, then the system produces message information data representing an

apparent information content of message A, whether partial or complete, and the qualified subset message A is subjected to a confirmation process in steps 42 and 44.

[0036] The determination 40 that the detected symbols constitute a qualified subset of the message A, is made based on predefined qualification rules. Satisfaction of a given rule in step 40 by message A causes the system 30 or 100 to assign message detection merit data M to message A indicating that the likelihood of its correct detection is less than 100%, but sufficiently high that message A may be deemed detected subject to confirmation.

[0037] In one embodiment, the detection of at least a predetermined minimum number of the symbols of message A constitutes a qualification rule. In another embodiment, the detection of an uninterrupted sequence of symbols having at least a predetermined minimum length serves as a qualification rule. In a further embodiment, the detection of one or more predetermined synchronization symbols of message A, together with a predetermined number of message information symbols serves as a qualification rule.

[0038] In still other embodiments, combinations of two or more of the foregoing qualification rules are employed, and satisfaction of any of several qualification rules or sets of rules, qualifies the detected symbol subset for confirmation in steps 42 and 44. A process for carrying out the step 40 by applying two qualification rules or criteria is illustrated in Figure 4, wherein satisfaction of either of the two rules or criteria qualifies the detected symbol subset. In a step 50, a first set of rules or criteria are applied to the symbol subset. If the symbol subset satisfies these rules or criteria, the message A is assigned message detection merit data M_i and processing continues to step 42. If not, processing instead continues in a step 54 in which a second set of rules or criteria are applied to the symbol subset. If the symbol subset satisfies the second set of rules or criteria, even if the first set is not satisfied,

the message A is assigned message detection merit data M_j, different from M_i, and the symbol subset is nevertheless deemed qualified for confirmation and processing continues to step 42.

[0039] In step 42, the system 30 or 100 determines whether one or more detected messages B of the stream of messages qualify to confirm the detection of message A represented by the qualified subset of symbols.

[0040] In certain embodiments, the message B is selected as the message immediately following the message A in the continuing stream of messages, as illustrated in Figure 5. In certain other embodiments, the message B is selected as the message immediately preceding the message A as illustrated in Figure 6. In still other embodiments, both the message immediately preceding the message A and the message immediately following message A are used to confirm a qualified subset of the message A.

[0041] In further embodiments, the message B precedes the message A to be confirmed by two or more message intervals, as illustrated in Figure 7. In still further embodiments, the message B follows the message A by two or more message intervals, as illustrated in Figure 8. In yet still further embodiments, both such messages are used to confirm the qualified subset of message A. Various combinations of three or more messages are also used in still more embodiments to confirm the qualified subset of message A.

[0042] In order to qualify for confirmation in step 42 of Figure 3, the message or messages B must satisfy one or more predetermined criteria. In certain embodiments, for a message to qualify for confirmation all of its symbols must be detected. However, in other embodiments, a detection of fewer than all of the symbols of a message may still qualify it for confirmation, so long as its message information is reliably established and/or it is only one of several confirming messages.

[0043] The system 30 or 100 produces message information data representing an apparent information content of message B, whether partial or complete, along with message detection merit data representing an assigned accuracy thereof. The message detection merit data of message B for confirmation purposes may be simply a binary symbol, but need not be.

[0044] If the message or messages B qualify to confirm the subset of A, a matching step 44 is carried out in order to confirm the apparent information content of the subset of A. In certain embodiments, the message or messages B must possess the same information content as the apparent content of the subset of A. In other embodiments in which the data is formatted so that a given information content of the message or messages B implies a different, but known information content of the message A, the correspondence of the apparent information content of the message A to such different but known information content confirms the subset of message A.

[0045] From the foregoing it will be seen that in the embodiment the confirmation of the message information data of message A depends on (1) the existence of a qualified subset of message A, as represented by its message detection merit data, (2) the qualification of message B to confirm message A, as represented by its message detection merit data, and (3) a match of the message information data of message A with that of message B.

[0046] In other embodiments, the message information data of message A is confirmed based only on its message detection merit data. For example, where a number of symbols of message A necessary to establish its information content have been detected, message A may be deemed confirmed based only on message detection merit data indicating a high probability that the message detection merit data is accurate.

[0047] Once a qualified subset of message A has been confirmed in step 44, data representing its information content with or without its message

detection merit data M, M_i or M_j is stored and/or transferred in step 46 for further processing.

[0048] In certain advantageous embodiments, the process of Figure 3 is modified, so that both, (i) the symbols of messages A and B are detected and, (ii) their respective message detection merit data are produced, in a monitoring system at a user location. This monitoring system is either a stationary device or a portable device carried by an audience member. The detected symbols and their respective message detection merit data are either communicated to a system which carries out steps 40, 42 and 44 of Figure 3, or else stored for subsequent communication to such a system.

[0049] An embodiment of the invention is now described for use in detecting a continuing stream of encoded messages having a format as disclosed in US patent application No. 09/318,045 hereby incorporated by reference herein. As illustrated in Figure 9, each such message is formatted as two redundant sequences of message information symbols X having two synchronization symbols, Sync 1 and Sync 2, interspersed therewith. The symbols Sync 1 and Sync 2 are distinct from one another, so that each represents a determinable position within the message symbol sequence. The message information symbols X are selected from a predetermined symbol set of n symbols in which the symbols are arranged in a predefined sequence, conveniently designated by an index i assigned to each symbol such that i = 1,2, ..., n. For example, the predefined symbol set may have three distinct symbols, so that n=3. However, n may be selected as any positive integer greater than 1 in this exemplary message format. Preferably, but not necessarily, each symbol in the predefined symbol set includes frequency components that are uniquely different from those of all other symbols of the set, in order to facilitate the unique detection of each symbol.

[0050] The symbols X of the redundant message sequences are arranged so that if the first symbol sequence is m symbols long, and each

symbol is selected from a symbol set of n unique symbols each designated by an index i, i=1, 2, ..., n, each symbol in a corresponding position within the second symbol sequence is selected as the symbol [i + j (mod n)] of the predefined symbol set, where j is a constant integer value referred to herein as an "offset". For example, if the predefined symbol set contains seven symbols in the order (X_1, X_2, ..., X_7), the first message sequence is $X_1X_5X_7$, and the offset j=2, then the second sequence is composed of the symbols $X_3X_7X_2$.

[0051] An advantageous embodiment of a method for detecting a message A formatted as in Figure 9 and included in a continuing stream of messages, is now described with reference to Figures 3 and 4. In step 34, the symbol sequence of message A is selected based on detection of at least one of the synchronization symbols Sync 1 and Sync 2. If both of the synchronization symbols are detected along with all of the message information symbols of both sequences, and each symbol of the second sequence has the correct offset j with respect to its corresponding symbol in the first sequence, then message A is deemed detected and assigned a highest message detection merit data value M_{MAX}. Then the message A is stored and/or transferred in step 46 with or without M_{MAX}.

[0052] However, if any of the symbols of message A is not detected and/or any of the message information symbols does not have the correct offset, processing continues in step 40. With reference also to Figure 4, in step 50 of step 40, it is determined whether at least one of the two synchronization symbols and all of the message information symbols have been detected, with all of the latter exhibiting the correct offset. If so, the detected subset of message A is assigned message detection merit data M_i indicating that the likelihood of its correct detection is less than maximum but sufficiently high to warrant confirmation processing. Based on data M_i, the processing continues in step 42.

[0053] If the symbol subset of message A does not satisfy the first set of criteria in step 50 as described above, it is evaluated under a second set of criteria in step 54. Under the second set of criteria, the symbol subset of message A can still qualify for confirmation processing if both synchronization symbols have been detected as well as all but one of the message information symbols. That is, if all symbol detections and offsets are present, except that one of the message information symbols either is absent or fails to exhibit the correct offset, then message A is assigned message detection merit data M_j indicating that the likelihood of its correct detection is less than maximum but still sufficiently high to warrant confirmation processing.

[0054] In this embodiment, message B preferably, but not exclusively, is selected as in Figure 5 or Figure 6. Message B qualifies in step 42 only if its assigned message detection merit data is M_{MAX}. That is, message B qualifies for confirmation only if all of its symbols have been detected (i.e., both synchronization symbols and all message information symbols) and all of its message information symbols have the correct offset.

[0055] If message B thus qualifies based on its message detection merit data M_{MAX}, then in step 44 the information content of message B is compared with the information content or apparent content of message A to detect whether they are the same. If so, the message A is deemed confirmed and its message information content is stored and/or transferred with or without its message detection merit data M_i or M_j.

[0056] Although the invention has been described with reference to a particular arrangement of parts, features and the like, these are not intended to exhaust all possible arrangements or features, and indeed many other modification and variation will be ascertainable to those of skill in the art.

What is claimed is:

1. A method for detecting data included in audio media data as a continuing stream of encoded messages, comprising:

detecting predetermined message data representing a predetermined message of the continuing stream of encoded messages;

producing message detection merit data representing an assigned accuracy of the detected predetermined message data as correctly representing an information content of the predetermined message; and

confirming correct detection of the predetermined message based on the message detection merit data.

2. The method of claim 1, wherein detecting the predetermined message data comprises detecting at least some message symbols of the predetermined message.

3. The method of claim 2, comprising producing message information data representing an information content of the predetermined message based on the at least some message symbols.

4. The method of claim 2, wherein the predetermined message comprises a plurality of message symbols arranged in a time sequence, the plurality of message symbols including the at least some message symbols of the predetermined message.

5. The method of claim 2 wherein detecting the predetermined message data comprises detecting a first synchronization symbol and a second synchronization symbol in the predetermined message.

6. The method of claim 5, wherein the first and second synchronization symbols in the predetermined message are separate and distinct from one another.

7. The method of claim 2, wherein detecting the predetermined message data comprises detecting message information symbols in the predetermined message, the message information symbols characterizing the audio media data.

8. The method of claim 2 wherein detecting the predetermined message data comprises detecting a first message information symbol and a second message information symbol in the predetermined message.

9. The method of claim 2, wherein the production of the message detection merit data is based on the reception of synchronization symbols and message information symbols in the predetermined message.

10. The method of claim 9, wherein the message detection merit data represents an assigned probability that the detected predetermined message data contains information correctly representing the predetermined message.

11. The method of claim 1, wherein producing message detection merit data comprises producing data representing a likelihood that the predetermined message data accurately represents the information content of the predetermined message.

12. The method of claim 11, comprising detecting further predetermined message data representing a further predetermined message of the continuing stream of encoded messages, producing further message detection merit data representing a likelihood that the further predetermined message data accurately represents an information content of the further

predetermined message, and wherein confirming correct detection of the predetermined message is based on the further predetermined message data and the further message detection merit data.

13. The method of claim 12, wherein confirming correct detection of the predetermined message comprises matching the predetermined message data with the further predetermined message data.

14. The method of claim 12, comprising detecting message information symbols of the predetermined message, the message information symbols characterizing the audio media data, and detecting further message information symbols in the further predetermined message, the further message information symbols characterizing the audio media data.

15. The method of claim 14, wherein a first message information symbol of the predetermined message and a first message information symbol of the further predetermined message each include frequency components different from frequency components of the other and represent the same information.

16. The method of claim 1, further comprising detecting further predetermined message data representing a further predetermined message of the continuing stream of encoded messages, producing further message detection merit data representing an assigned accuracy of the detected further predetermined message data as correctly representing an information content of the further predetermined message, and confirming correct detection of the predetermined message based on the further predetermined message data and the further message detection merit data.

17. The method of claim 16, wherein the message detection merit data and the further message detection merit data represent probabilities of

correct detection of the predetermined message data and the further predetermined message data.

18. The method of claim 16, comprising producing message information data representing an information content of the predetermined message based on the predetermined message data and further message information data representing an information content of the further predetermined message based on the further predetermined message data, and confirming correct detection of the predetermined message based on the further message information data.

19. A system for detecting data included in audio media data as a continuing stream of encoded messages, comprising:

detecting means for detecting predetermined message data representing a predetermined message of the continuing stream of encoded messages;

merit data producing means for producing message detection merit data representing an assigned accuracy of the detected predetermined message data as correctly representing an information content of the predetermined message; and

confirming means for confirming correct detection of the predetermined message based on the message detection merit data.

20. The system of claim 19, wherein the detecting means serves to detect at least some message symbols of the predetermined message.

21. The system of claim 20, comprising means for producing message information data representing an information content of the predetermined message based on the at least some message symbols.

22. The system of claim 20, wherein the predetermined message comprises a plurality of message symbols arranged in a time sequence, the plurality of message symbols including the at least some message symbols of the predetermined message.

23. The system of claim 20, wherein the detecting means serves to detect a first synchronization symbol and a second synchronization symbol in the predetermined message.

24. The system of claim 23, wherein the first and second synchronization symbols in the predetermined message are separate and distinct from one another.

25. The system of claim 20, wherein the detecting means serves to detect message information symbols in the predetermined message, the message information symbols characterizing the audio media data.

26. The system of claim 20, wherein the detecting means serves to detect a first message information symbol and a second message information symbol in the predetermined message.

27. The system of claim 20, wherein the merit data producing means serves to produce the message detection merit data based on the reception of synchronization symbols and message information symbols in the predetermined message.

28. The system of claim 27, wherein the message detection merit data represents an assigned probability that the detected predetermined message data contains information correctly representing the predetermined message.

29. The system of claim 19, wherein the merit data producing means serves to produce the message detection merit data representing a likelihood that the predetermined message data accurately represents the information content of the predetermined message.

30. The system of claim 29, wherein the detecting means serves to detect further predetermined message data representing a further predetermined message of the continuing stream of encoded messages, the merit data producing means serves to produce further message detection merit data representing a likelihood that the further predetermined message data accurately represents an information content of the further predetermined message, and wherein the confirming means serves to confirm correct detection of the predetermined message based on the further predetermined message data and the further message detection merit data.

31. The system of claim 30, wherein the confirming means matches the predetermined message data with the further predetermined message data.

32. The system of claim 30, wherein the detecting means serves to detect message information symbols of the predetermined message, the message information symbols characterizing the audio media data, and to detect further message information symbols in the further predetermined message, the further message information symbols characterizing the audio media data.

33. The system of claim 32, wherein a first message information symbol of the predetermined message and a first message information symbol of the further predetermined message each include frequency components different from frequency components of the other and represent the same information.

34. The system of claim 19, wherein the detecting means serves to detect further predetermined message data representing a further predetermined message of the continuing stream of encoded messages, the merit data producing means serves to produce further message detection merit data representing an assigned accuracy of the detected further predetermined message data as correctly representing an information content of the further predetermined message, and the confirming means serves to confirm correct detection of the predetermined message based on the further predetermined message data and the further message detection merit data.

35. The system of claim 34, wherein the message detection merit data and the further message detection merit data represent probabilities of correct detection of the predetermined message data and the further predetermined message data.

36. The system of claim 34, comprising means for producing message information data representing an information content of the predetermined message based on the predetermined message data and further message information data representing an information content of the further predetermined message based on the further predetermined message data, and the confirming means serves to confirm correct detection of the predetermined message based on the further message information data.

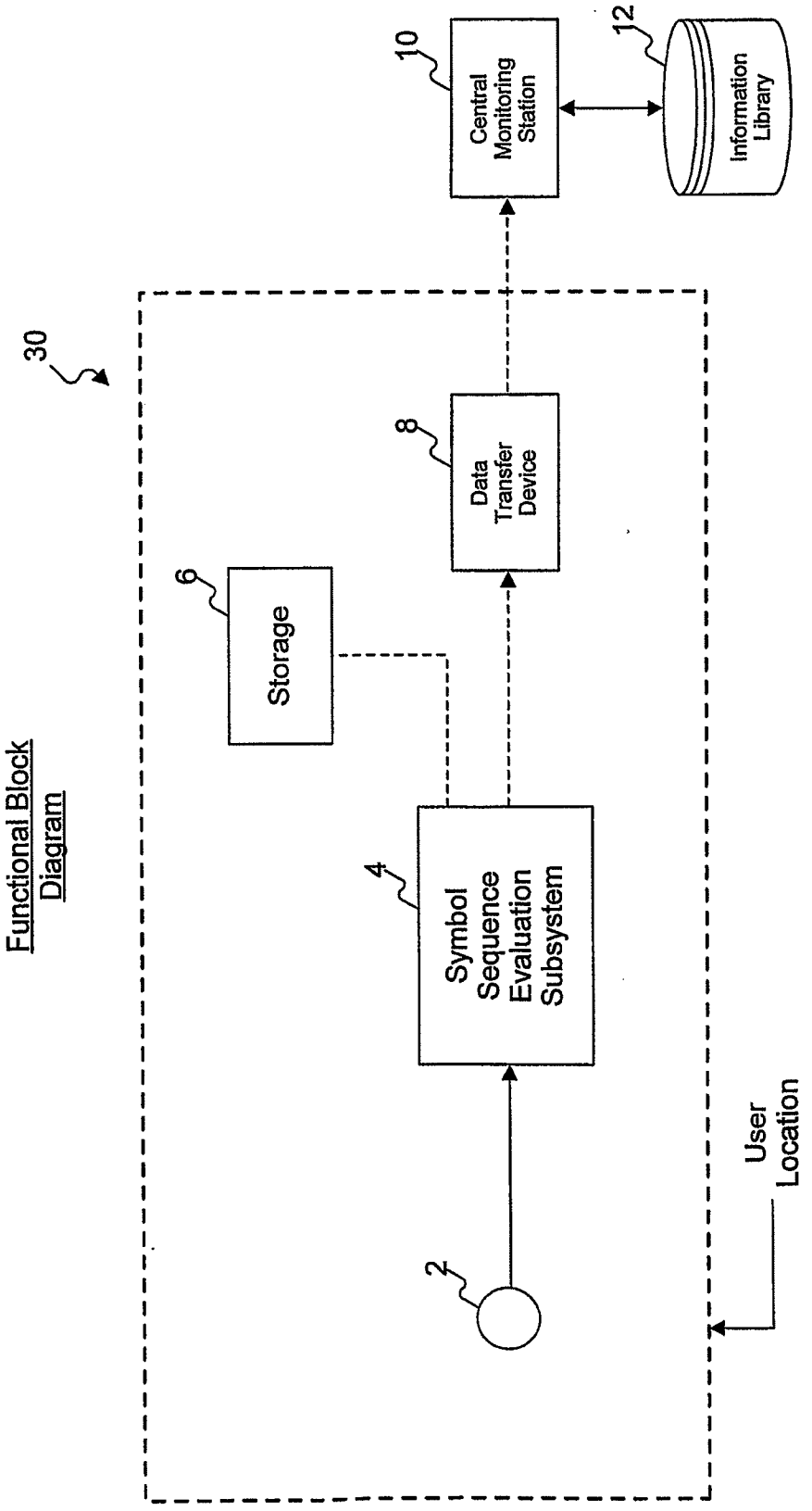

Functional Block Diagram
30
10
Central Monitoring Station
12
Information Library
8
Data Transfer Device
6
Storage
4
Symbol Sequence Evaluation Subsystem
2
User Location

FIGURE 1

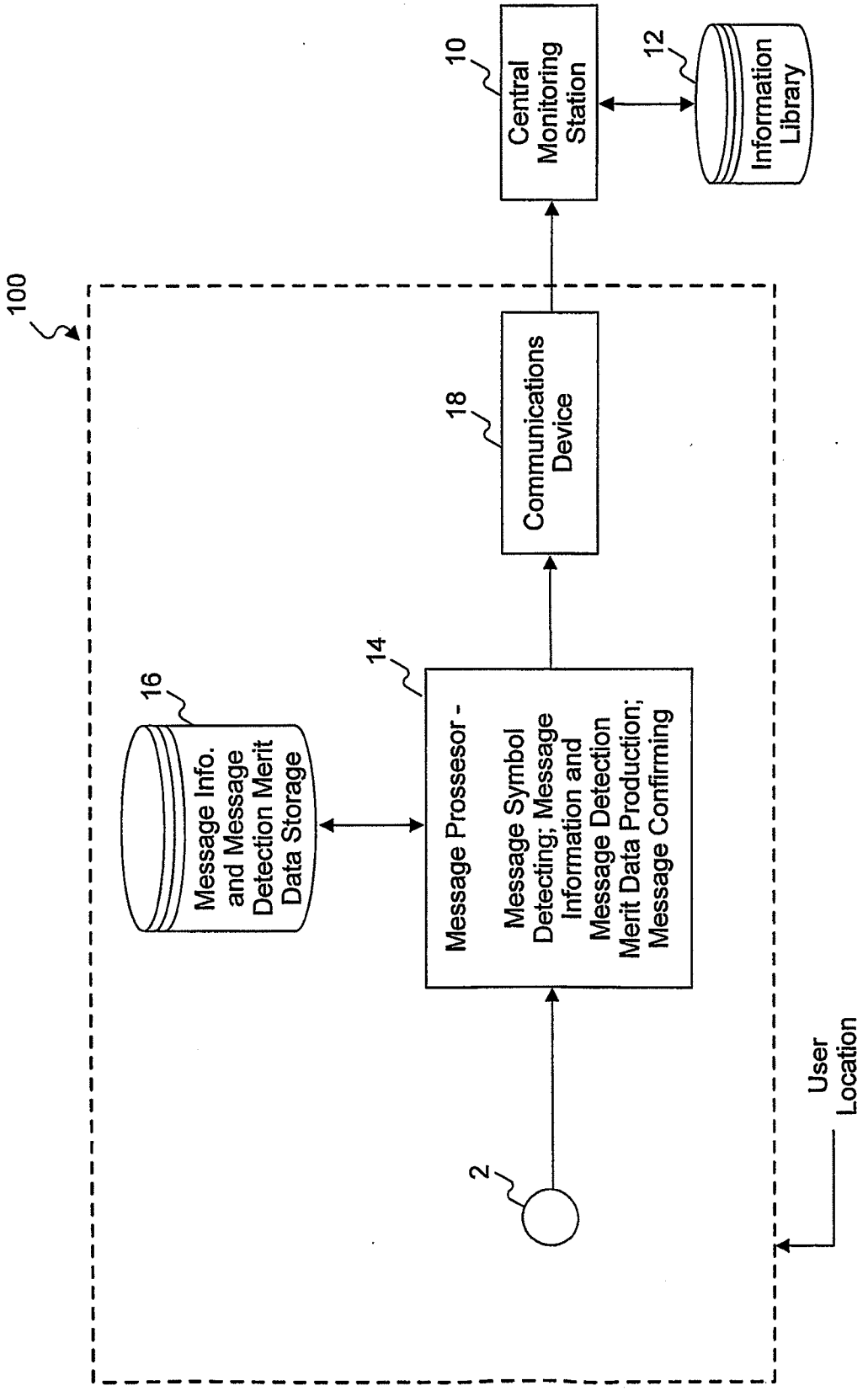

100
10
Central Monitoring Station
12
Information Library
18
Communications Device
14
Message Prossesor - Message Symbol Detecting; Message Information and Message Detection Merit Data Production; Message Confirming
16
Message Info. and Message Detection Merit Data Storage
2
User Location

FIGURE 2

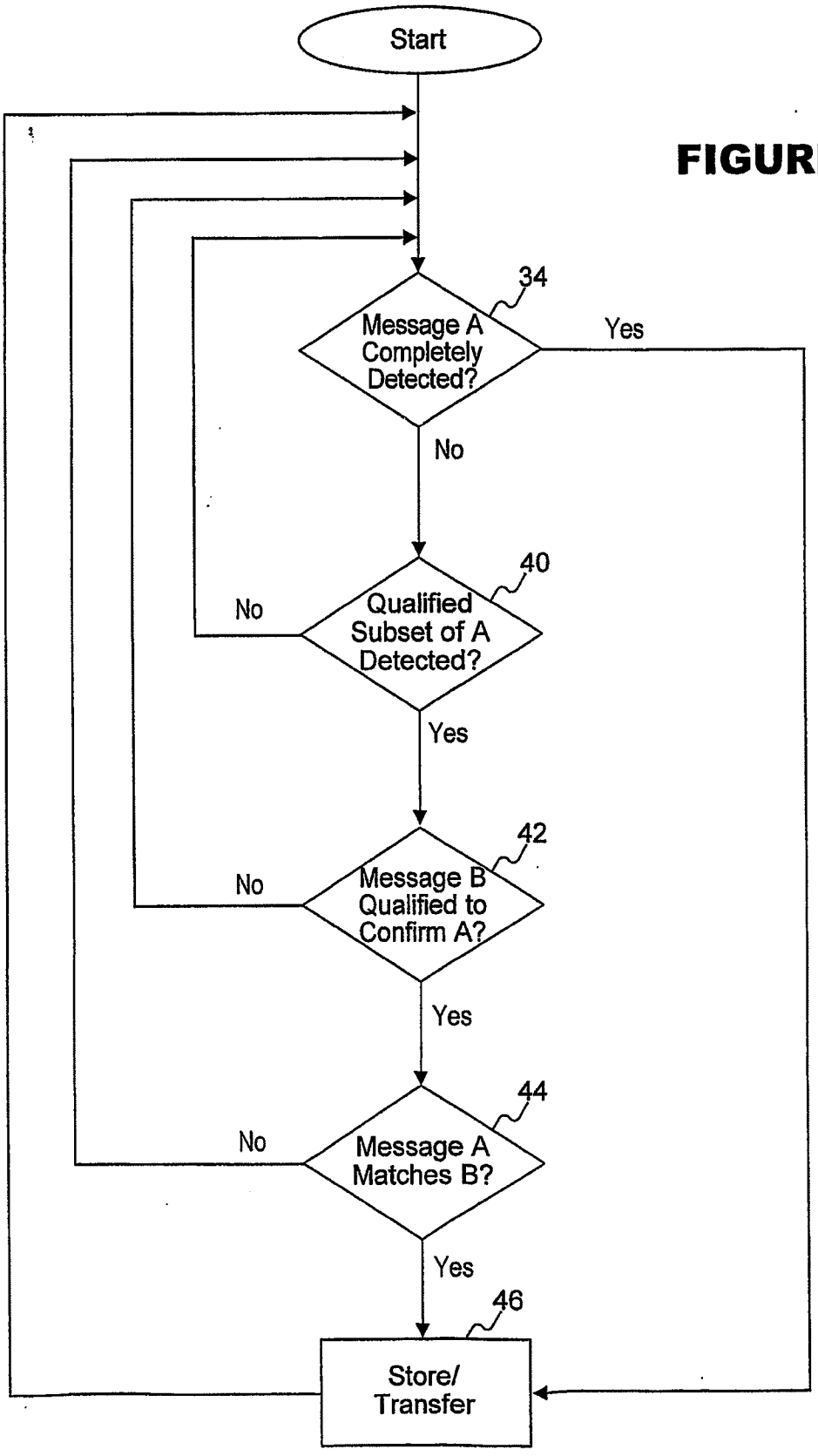
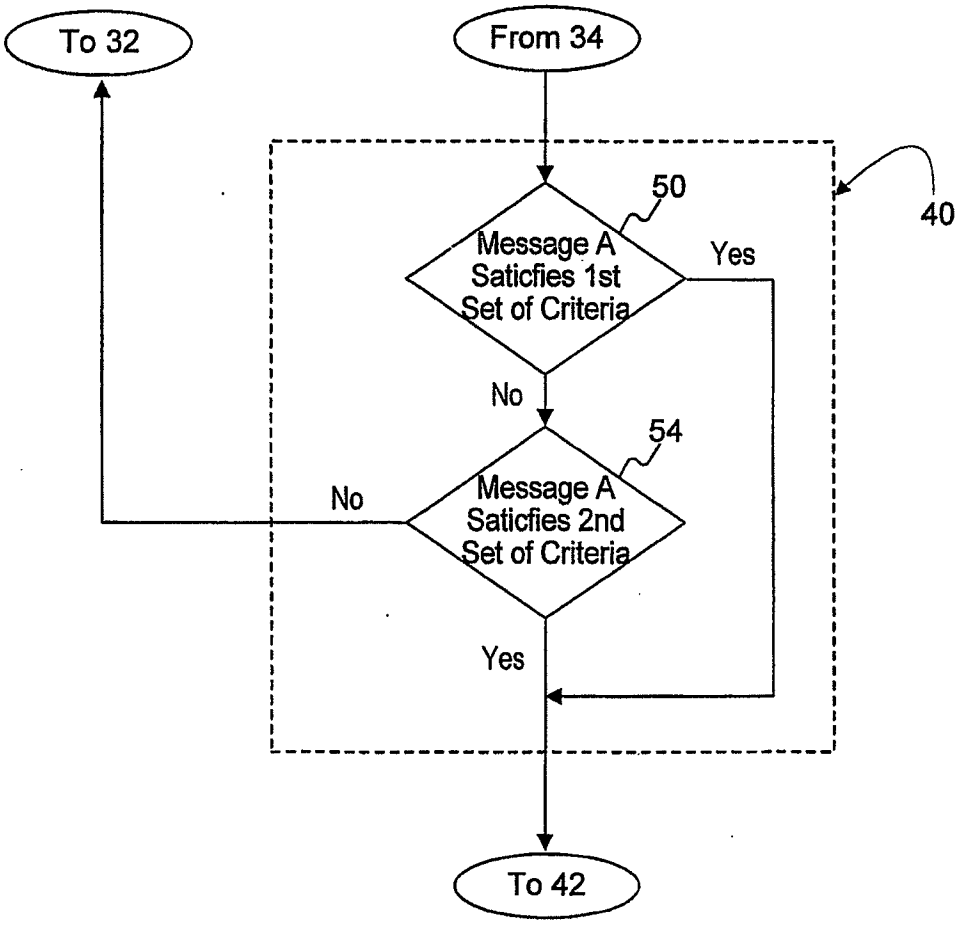

Start
34
Message A Completely Detected?
Yes
No
40
Qualified Subset of A Detected?
No
Yes
42
Message B Qualified to Confirm A?
No
Yes
44
Message A Matches B?
No
Yes
46
Store/ Transfer

FIGURE 3

FIGURE 4


To 32
From 34
40
50
Message A
Saticfies 1st
Set of Criteria
Yes
No
54
Message A
Saticfies 2nd
Set of Criteria
No
Yes
To 42

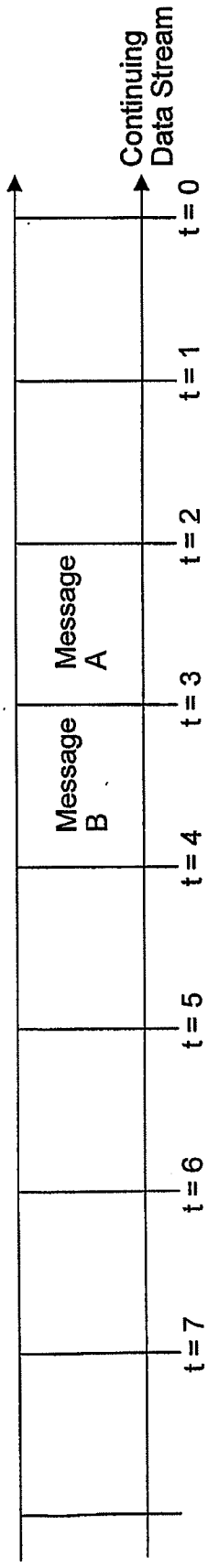

Continuing
Data Stream
t = 0
t = 1
t = 2
t = 3
t = 4
t = 5
t = 6
t = 7
Message
A
Message
B

FIGURE 5

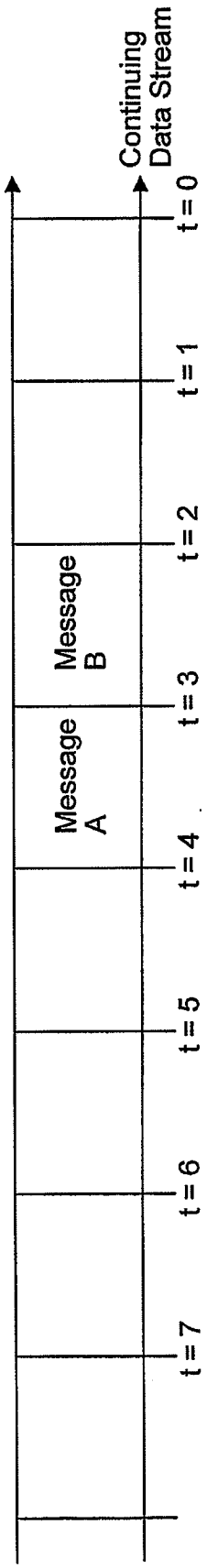

Continuing
Data Stream
t = 0
t = 1
t = 2
Message
B
t = 3
Message
A
t = 4
t = 5
t = 6
t = 7

FIGURE 6

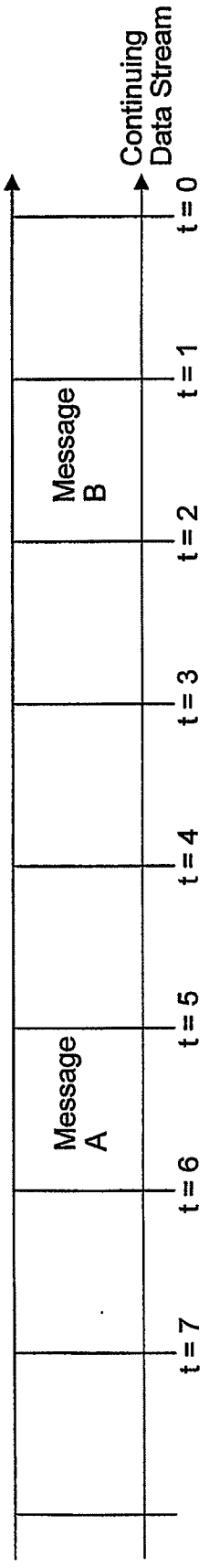

Continuing
Data Stream
t = 0
t = 1
t = 2
t = 3
t = 4
t = 5
t = 6
t = 7
Message
B
Message
A

FIGURE 7

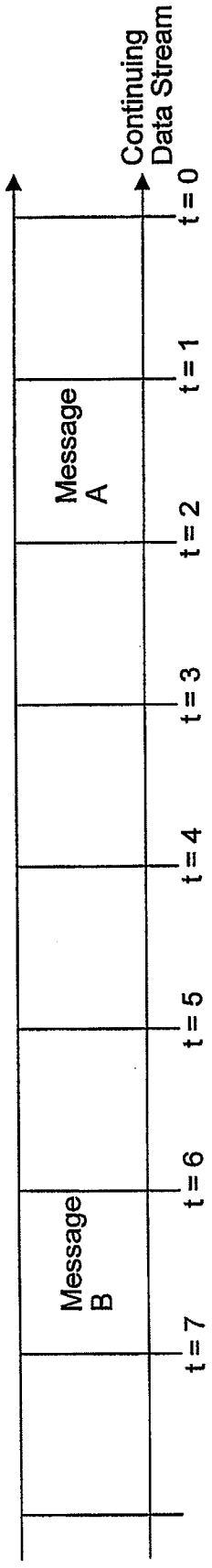

Continuing
Data Stream
t = 0
t = 1
t = 2
t = 3
t = 4
t = 5
t = 6
t = 7
Message
A
Message
B

FIGURE 8

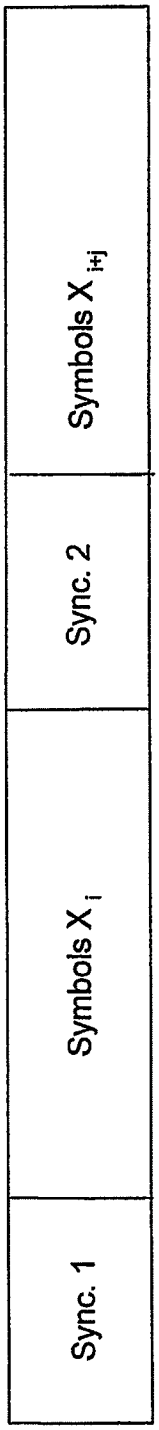


FIGURE 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US02/27323

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : HO4L 9/00
US CL : 380/42,252,253,254; 375/130; 341/51

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : 380/42,252,253,254; 375/130; 341/51

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Please See Continuation Sheet

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y,P	US 6,311,271 A(GENNARO et al) 30 October 2001, col.4,lines 23-67; col.5,lines 30-67.	1-36
Y	US 6,266,349 A(FUKUI et al) 24 July 2001, col.6,lines 39-60; col.7,lines 28-40; col.10,lines 1-39	1-36
A	US 5,945,932 A(SMITH et al) 31 August 1999, col.3,lines 11-35; col.4,lines 49-65.	1-36
A	US 6,029,266 A(LEE) 22 February 2000, col.4,lines 58-65; col.6,lines 42-60.	1-36

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
06 December 2002 (06.12.2002)	26 DEC 2002
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703)305-3230	Authorized officer Gail Hayes for Jessica R. Matthews Telephone No. 703-305-0042

Form PCT/ISA/210 (second sheet) (July 1998)

Continuation of B. FIELDS SEARCHED Item 3:
EAST
search terms: stream,encode,data,files,multimedia,messages,correct,error,predetermine,confirm,synchronize